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DEFENSE OF THE
PANAMA ROUTE

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A DEFENSE

OF THE

PANAMA ROUTE

BY

PROF. ANGELO HEILPRIN, F. R. G. S.,

Vice-President of the Geographical Society of Philadelphia; Member of the
American Philosophical Society, of the Board of Managers of the
National Geographic Society of Washington, of the
Geological Society of America, etc.

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A DEFENSE OF THE PANAMA ROUTE.

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The final report (Senate Document No. 54, 1901) of the Isthmian Canal Commission so manifestly sets forth the engineering advantages of the Panama Canal route, while giving a decision in favor of the Nicaragua route, that it is no longer necessary to enter upon a discussion of this phase of the canal problem. Aside, however, from conceding what had been very generally known to engineers before the Commission came into existence, and furnishing a valuable summary of the work made in the field by its special experts (the details of which are published elsewhere), the report is singularly defective in some of its particulars, and will be judged by many to emphasize largely, or even wholly, erroneous conclusions. These conclusions touch not so much important questions in engineering as they do those of geography (commerce) and geology.

THE SHORT COMMERCIAL ROUTE.

It will be seen that this report says: "For the commerce in which the United States is most interested, that between our Pacific ports and Atlantic ports, European and American, the Nicaragua route is shorter by about one day.

The same advantage exists between our Atlantic ports and the Orient" (p. 260). While it may be easily denied, in view of the rapid development of trade with South America and the fact that the transcontinental railroad lines will always be competitors in freight carriage to and from the vast interior of the national domain, that the canal commerce in which the United States is most interested is that which links the eastern and western ports of our own country, the *error* of the conclusion that for this commerce the Nicaragua route is shorter by about one day cannot be questioned. The Commission affirms that the estimated time for a deep-draft vessel to pass over the contemplated Panama route is 12 hours, and over the Nicaragua route—the longer by 134.57 miles—33 hours, giving the advantage of 21 hours to the Panama route. Applying this advantage to steamers of different sailing powers, to those of 13 knots, 15 knots, and 20 knots (cruisers), we obtain as profit to the vessels using the Panama route 139, 181, and 286 knots respectively. The U. S. Hydrographic Office furnishes the data regarding the different sailing routes, and gives an actual saving in distance (between New York and San Francisco) by the use of the Nicaragua route of 377 miles. Therefore, the net gain by the Nicaragua traverse would be this amount *less* the loss in making the long isthmian journey: 238 miles (or 18.3 hours) for the 13-knot steamers; 196 miles (or 13 hours) for the 15-knot steamers, and 91 miles (or 4.5 hours) for the 20-knot cruisers. A consideration of a 10-knot speed, which appears to underlie the result obtained by the Commission, may be interesting, but is hardly of value in the determination of canal construction, since it is certain, with the rapid development of speed-power, that but few vessels entering as com-

petitors for freight in an extended ocean course will in the future be constructed with a speed-power of less than 14 or 15 knots.

The conditions in regard to the course to the Orient are still more favorable to the Panama route, for the saving in actual distance via Nicaragua, as the data of the Hydrographic Office show, is only 255 miles. Therefore, steamers of 13 knots using the Nicaragua route would have the advantage over the Panama steamers of only 9 hours (116 miles) in the course to Yokohama and Shanghai; and those of 15 knots, of only 5 hours (74 miles). The swift-flying cruiser of 20 knots would, on the other hand, lose $1\frac{1}{2}$ hours (31 miles). In the course to Australia the advantage would lie with the Panama route. It is needless to say that these slight differences of disadvantage or advantage, over courses of 5,000 and 10,000 miles length, practically parallel the two routes. The conditions are, however, *wholly* different when the course with the western ports of South America is considered, and concerning which the Commission reports: "For commerce between North Atlantic ports and the west coast of South America the Panama route is shorter by about two days" (p. 261)—*a saving of two days in a traverse (to Guayaquil) of only 2,900 miles!*

In this determination of travel-time the figures given by the Isthmian Canal Commission for the traverse of the two routes have been accepted merely for the purpose of presenting the problem in the most favorable aspect taken from the viewpoint of the Commission. It is, however, positively certain that if the average passage over the Panama route is to be taken at 12 hours, no vessel would or *could* make the average Nicaragua passage—longer by 134 miles, with a con-

siderably higher summit level, and through a canal with twice the number of locks with much more rapid curves—in 33 hours. It is not alone the question of actual sailing time, but that of delays, which has to be taken into account into the resolution of traverse-time; and it is needless to say that over a long canal course the possibilities (certainties) of delays of different kinds are accentuated in a very different degree from what they would be over a short canal course. It can reasonably be accepted that 40 hours would more nearly represent the actual traverse of the Nicaragua Canal than 33 hours. With this time allowance the Panama Canal would be made the virtual equal of the Nicaragua Canal even in the trade route between our Atlantic ports and the Pacific ports of the United States, for a 15-knot steamer traversing it would only lag 77 miles (5.1 hours) of its Nicaraguan competitor in the voyage to San Francisco, while a 20-knot cruiser would be in advance by 63 miles (3.1 hours).

It is manifest, therefore, that with practically no saving advantage to either route in the course to the western coast of the United States and the ports of the Orient, and with a most marked advantage to the Panama route in the course to the western coast of South America, the *true commercial isthmian route is that of the Panama Canal.*

THE DANGER FROM VOLCANIC DISTURBANCES.

In its Preliminary Report, submitted to Congress in December, 1900, the Isthmian Canal Commission is silent on the subject of the dangers from earthquake and volcanic disturbances to which the Nicaraguan Canal would be subject, manifestly considering as satisfactory the report of the Geologist of the Nicaragua Canal Commission (whose labors prac-

tically excluded this field of inquiry) confirming the report of the earlier geologist employed by the Maritime Canal Company that the risk of serious injury was "so small that it ought to be neglected alike by the Maritime Canal Company, the Construction Company, and by contemplating investors." It is probably on the strength of this opinion that the Nicaragua Canal Construction Company, in their brochure on "The Inter-Oceanic Canal of Nicaragua" (1891), exultingly refers to the "grand old" cathedral of Leon as having "for more than a century and a half . . . stood the vicissitudes of earthquake, weather, war, piracy, revolution, and its walls are still solid and unshaken," and define the risk of injury to Nicaragua Canal construction by earthquakes as existing only "in the theories of those who are interested in the making a canal at some other locality or in the mind of the man who is naturally a pessimist and opposed to all bold undertakings." This vain-glorying was, however, rebuked in less than a decade, for, on April 29, 1898, a violent earthquake, which agitated the whole of Nicaragua, and had its greatest intensity in the plain of Leon, destroyed (as we are informed in the report of the Government Technical Commission of Nicaragua) 340 houses in the city of Leon, besides inflicting considerable damage elsewhere. Even the "grand old" cathedral had its walls and cupolas rent with cracks.

In its present final report, the Isthmian Canal Commission finds it necessary to enter into a brief discussion of this subject, which, indeed, might be considered to be rather an apology for a discussion than a discussion itself. Little sympathy can be had for a report which dismisses this all-important topic in hardly more than three pages, and uses as

its main argumentative text Humboldt's *Cosmos*, the first American edition of Lyell's *Principles of Geology*, the second edition of Daubeny's *Volcanoes*, and the fragmentary (and confessedly incomplete) list of earthquakes prepared by Montessus de Ballore. The sciences of vulcanology and seismology have made such rapid advances during the last quarter of a century that one wonders how reference can be made to these works for "authority"; nor is it more intelligible how Humboldt's earliest conception of the relation of the mountain systems of the two continents, which Humboldt himself quite gave up upwards of forty years ago, can be taken as the modern guide in the study of the region in question. We are told that a glance at the map appended to the report will show "that the entire isthmus between North and South America is a volcanic region," and, following Humboldt, that "the grandest example of a continental volcanic 'chain' is offered by the great rampart of the Andes extending from the southern part of Chile to the northwest of America" (p. 168). It has, however, been known for a full quarter of a century that the main Andes do *not* traverse the Isthmus of Panama, and that there are no active or recently decayed volcanoes in any part of the true isthmus. So far, therefore, as danger from direct volcanic contacts is concerned, the Panama route is exempt. The case is very different with the Nicaragua route, whose line is laid across the almost continuously volcanic tract that binds Costa Rica with Salvador, and which has been, during the period of the last three-quarters of a century, probably the most violently eruptive of any in the Western Hemisphere. On the line of crustal weakness that is occupied by Lakes Nicaragua and Managua there are distributed over a linear distance of

little more than 200 miles not less than 25 volcanoes, most of which have been active within a very modern period of time, while a number are still active to-day. A few actually lie within the basin of Lake Nicaragua itself. Coseguina, which lies only 60 miles distant from the line of the initially-proposed canal, went through a paroxysm in 1835 which has been described by the Geologist of the Nicaragua Canal Commission as "the most violent recorded eruption until surpassed by that of Krakatoa in 1883." Yet, in the face of these facts, known to all geographers and geologists, the Isthmian Canal Commission would have us believe that so far as danger from this source is concerned the two routes stand equal!

It is not a little surprising that the only source of danger that the Commission associates with volcanic manifestations is that dependent upon the secondary phenomena of earthquakes. The individual volcanic catastrophe, as such, does not enter for consideration; and yet it is only fifteen years ago (1886) that the great Lake of Rotomahana, in New Zealand, was wrecked and emptied of its water through the eruption of a volcano (Tarawera), thought to have been extinct for upwards of a hundred years! And only a few years earlier (1879-80), the waters of Lake Ilopango, in Salvador, had been lowered 35 feet as the result of an eruption in that body of water. The physiographic conditions of Rotomahana previous to 1886 could have been precisely paralleled with those now existing about the lake region of Nicaragua.

THE CONDITIONS OF EARTHQUAKE PHENOMENA.

It is difficult to comprehend the conclusion arrived at by the Isthmian Canal Commission regarding the dangers to

be feared from earthquake disturbances. Were the subject not so important a one, a geologist might be led to assume that the discussion as it is presented was not intended to be treated seriously. We are told that in general terms "the region of volcanoes is the region of earthquakes, but the immediate vicinity of the volcanoes is not necessarily the most dangerous part of the region"—a statement that is presumably intended to carry with it the inference that the region of Panama, which is distantly removed from volcanoes, is about as likely to suffer from earthquake disturbances as the region of Nicaragua, which is in close proximity to or in direct association with volcanoes! The basis of this singular conclusion appears to be the "doctrine," "accepted by such writers as Baron Von Humboldt, Sir Charles Lyell, Prof. Charles Daubeny, and J. Le Conte," that volcanoes are "safety valves which diminish the violence of earthquakes in their vicinity" (p. 167)! One can readily admit that were it not for the presence of active volcanoes certain earthquakes in particular regions would be more destructive than they have actually shown themselves to be, but this in no way affects the general proposition that earthquakes centre about the volcanoes. While it is perfectly true that many and even very destructive earthquakes, such as those of Lisbon, in 1755, and Charleston, in 1886, have taken place in absolutely non-volcanic regions, and will repeat themselves as such in the future, it is equally true that every region of marked volcanic activity, or crustal weakness, is one distinguished by earth-movements and dislocations. The Costa Rican-Nicaraguan-Guatemalan region is one preëminently of this class, and one need have no more impressive testimony to this condition than the destruction, either complete or in large part, of the town of

Cartago, in Costa Rica, four times in the course of the past century (1803, 1841, 1851, 1854), the destruction ten times of San Salvador and seven times of the city of Guatemala. The town of Rivas, at the precise outlet of the proposed Nicaragua Canal from Lake Nicaragua, was almost completely destroyed by the earthquake of 1844, which also wrecked considerable damage to Greytown, the inlet to the proposed canal. Mr. E. G. Squier, former Chargé d'Affaires of the United States to the Republics of Central America, describing the earthquake of 1844, states that the waters of Lake Nicaragua "were observed to rise and fall with the throes of the earth."

It is well known, and the fact is admitted in the report of the Isthmian Canal Commission, that the only recorded earthquake on the Panama tract "that could be called destructive," in a period of over three centuries (or from the time of the Spanish Conquest to the year 1886), was the earthquake of 1621, which destroyed the greater part of Panama. It is, therefore, surpassing strange, with these convincing facts before it, that the Commission should not find it possible "to justify a comparison between the Nicaragua and Panama routes as to either the number of earthquakes or their severity" (p. 168). The recent shocks reported from Greytown must add to the embarrassment in drawing a conclusion. Were the volcanic "safety-valves" not present, it would, perhaps, be easier to resolve the question; but, then, it might pertinently be asked, What was Vesuvius doing during the great Neapolitan earthquake of 1857? What, again, was it doing in 1886, when the city of Casamicciola, on the Island of Ischia, was wrecked, or what was the function of Etna, at the time of the destruction of Catania, in 1693?

What was the particular aid that the volcano of Irazú, in Costa Rica, gave to the town of Cartago, lying near its base, when it was wrecked in the years 1803, 1841, 1851, and 1854—or that which the Volcan de Fuego gave to the ancient city of Guatemala? These instances and others that might be cited almost without number, ought to be sufficient to convince all who are not particularly interested in canal constructions that the presence of an active volcano is no safeguard or “mitigating circumstance” in the calculation of earthquake possibilities. Its presence, on the contrary, is a warning signal forever, for the conditions that brought it into existence are the very ones that make earthquakes, of one class at least.

THE WATER SUPPLY OF LAKE NICARAGUA INSUFFICIENT FOR
THE NICARAGUA CANAL.

In earlier papers on the water supply of Lake Nicaragua attention is called to the surprising fact, developed by the investigations of the Nicaraguan and Isthmian Canal Commissions, that, if these investigations are accurate and to be relied upon, the water in the lake must be a continuously diminishing one, since the San Juan River and the general evaporation from the surface of the lake remove more than the annual rains supply to the lake basin. This conclusion, pertinent to the question of the instability and steady abasement of the lake level, and its effect upon a canal requiring a permanent summit level, has been warmly dissented from by the Geologist and Hydrographer of the Commissions. In its present report, however, by accepting the impugned or presumably unreliable data of rainfall made at Rivas and Masaya, and the observations on evaporation made by its

Chief Hydrographer, the Commission virtually assumes the condition, and finds it necessary to throw out the warning that "no wastage whatever would be permitted during such a low-water wet season as that of 1890. The rainfall from the entire drainage basin would be impounded in the lake, and it would then fall short of restoring the depletion resulting from evaporation and requirements of the canal" (p. 146). As a result of the operations of the nineteen months of that particular season (calculating from November, 1889, to June, 1891), the Commission says: "In other words, in spite of all storage of available water during the nineteen months, evaporation from the lake and the use of the canal have run the elevation of the lake surface down from 110.2 to 104 (feet), representing the net depletion of 6.2 feet in depth of lake water" (p. 153).

The menace to a permanent canal from a condition of this kind—the loss of its water—is so serious that only the most conclusive evidence as to the non-recurrence in successive periods of low water should be accepted as proving the "recovery" of the lake in the alternate wet periods. The Commission appears to have satisfied itself on this point, for in its report it says: "The entire record for fifteen years, from 1886 to 1900, at Granada and Masaya, shows but one year, 1890, with insufficient precipitation during the rainy season to fill the lake and restore the amount evaporated" (p. 154). This conclusion is *not* borne out by the data that are supplied in the special reports of the Chief Engineer and the Chief Hydrographer. It is shown, for example, that between the months of November, 1893, and May, 1897, the total rainfall was at Rivas 192 inches (and at Masaya 133 inches), which according to the formula furnished by the Chief Engineer of the Nicaragua Canal Commission, would

have raised the surface of the lake, were there no outflow and no evaporation, by almost exactly 200 inches. The evaporation during the same period of three and a half years, as computed by the Chief Hydrographer, would be 210 inches—a loss to the lake, therefore, of 10 inches, *allowing not a particle of overflow with which to supply the canalized river, and not permitting a drop of wastage of any kind.*

Precisely the same condition presented itself in the interval from November, 1882, to May, 1886, and our knowledge is much too imperfect to permit us to say with any degree of positiveness that much more unfavorable conditions may not present themselves in the future.

The facts in our possession, then, manifestly, do *not* justify the conclusion of the Commission that the “lake affords an inexhaustible water supply for the canal” by the Nicaragua route (p. 257). They show plainly the reverse: that the supply is insufficient, and that no amount of storage or raising to high level compatible with the security of the construction and general convenience can give sufficient margin of “retained” water to insure a serviceable canal.

CONCLUSION.

The broad conclusions that can be drawn from all the premises are:—

1. Commercially, the true trans-isthmian route is that of the contemplated Panama Canal.

2. Constructionally,—as involving less engineering difficulties, avoiding the superior risks from earthquake and volcanic disturbances and water shortages, and presenting a far more acceptable course for steaming,—the Panama Canal, of the two canals under general discussion, alone merits serious consideration.

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